

# VISUALISATION AND ANIMATION OF THE HISTORIC TOWN CENTRE OF TELC

Karel Pavelka

Czech Technical University in Prague, Faculty of Civil Engineering,  
Dept. Mapping and Cartography, Thákurova 7, 166 29, Prague 6, Czech Republic  
Tel.: +42024354951, Fax: +42024310774, E-mail: pavelka@fsv.cvut.cz

## Commision V, WG V/6

**KEY WORDS:** digital photogrammetry, landscape documentation, Internet presentation

### ABSTRACT

Examples of visualisation and animation of photogrammetric digitally processed data are discussed in the paper. At the Czech Technical University in Prague, photogrammetric measurement is performed in the framework of the co-operation between the Laboratory of Photogrammetry (Faculty of Civil Engineering) and the Laboratory of Quantitative Methods of Monuments Research (Faculty of Nuclear Physics and Physical Engineering). A large project on historical monument documentation and presentation by using a new digital technology has been started. The project is defined as a complex research for historical monument documentation and presentation using digital photogrammetry and GIS. The measured data set processed into a digital model serves as a basis for architectural and historical analysis. For testing of a new technology, some examples such as the historical centre of the town Telc were selected. The measurement of historical part of the town Telc represents the spatial (3D and 2.5D) analysis of about 50 objects (facades) and several interiors of historical buildings. The photogrammetric measurement involves the use of various methods (geodetic micro-network, DTM, analytical aerotriangulation, UMK cameras, réseau camera, non-metric digital cameras and video sequences). The results will be summarised into an intelligent database in the form of hypertext (XML language) with images, planes and with references; the platform will be CD-ROM and Internet (www). The idea is to collect all the data into an intelligent database and as a classical GIS system with the link between historical objects and maps. The expected output is documentation of the project data and their digital presentation by using of new animation techniques. MicroStation and AutoCAD systems can contribute to better precision of image processing. Vector output, rendering and animation software as Multigen with export to VRML (Virtual Reality Modelling Language) files were used for final presentation.

## 1. INTRODUCTION

### 1.1 Monuments Documentation

The Czech Republic is rich of monuments in various architectonic styles. At the Laboratory of Photogrammetry and Lab. of Quantitative Methods, usually 4-5 precise projects per year are carried out. It is still not sufficient.



Figure1. The historic town centre of Telc

Recently, a method of simple digital photogrammetry for filling of the monument database with help of students has been implemented. Based on the grant of the Czech Grant Agency and CTU Science Programme, a large long-term

project for historical monument documentation by using a new digital technology has been started (1999-2003). The project is defined as a complex research for historical

Figure 2. Aerial image of the historic town centre



monument documentation using digital photogrammetry, physical methods and GIS. Photogrammetry represents a substantial part of the project. For technology testing, some historical monuments were selected (compact buildings, wall paintings, sculptures and large building complex, such as the historical centre of the town Telc). The targets of the project are to do the 2D and 3D measurements together with testing of new digital methods for the terrestrial photogrammetry. In the case of the historical centre of the town Telc, not only geometric measurement was planned. Another aim is to propose an optional procedure for measuring historical

objects and especially creating of the classified knowledge about Telc gained through historical and architectural analysis in the form of an information system connected to the state coordinate system.

## 1.2 History

The origins of Telc go back to 12th and 13th centuries, when a Slavic settlement appeared on the site of the present town near a ford in the Telc stream. During the 13th century, the



settlement developed and grew to include areas occupied by  
Figure 3. Telc - view on the town square

today's historical town centre. The further development of Telc was in gothic style, which is evident even now. Dynamic growth of Telc was interrupted in 1386 by a fire, which destroyed the parish church and rectory, together with nearly thirty other houses. The early 15th century, with its economic, social and religious conflicts, was a period of disorder. Several buildings were damaged during a military campaign. The late Gothic period ended with another fire, which struck the central area of Telc in 1530. Under a new owner by the name of Zachariáš of Hradec the castle residence was renovated in renaissance style and dramatically expanded to one of the great jewels of renaissance architecture in the Czech lands. The renovating of the castle changed the face of the town itself. Arcades and a new style of gable were added to the houses on the square. The original renaissance appearance of most of these houses has been preserved to this day. After the Thirty Years war a new epoch of Telc was started. A large complex of Jesuit structures which represents a valuable example of early Baroque art in the Czech lands was built. Other monuments of the Baroque period can be found outside the historic centre, as well as in the town's environs in the second half of the 17th century. The first half of the 18th century was a period of the high Baroque in Telc. In 1970 the Ministry of Culture declared this area an Urban Historical Reservation. In 1992 Telc was included to the prestigious UNESCO World Heritage List of Cultural and Natural Monuments.

## 2. CONCEPTION AND METHODOLOGY

### 2.1 Photogrammetric Measurements

The modern animation methods for historical monument presentation represent at first precise measurement in terrain. Large documentation and presentation with animation of the historical part of the town Telc must be based on geodetic

measurement and the 3D – 2D evaluation of about 50 objects (facades) and several interiors of historical buildings. The project aim is not only documentation, but also the result presentation using new

Figure 4. Single photos

technologies. For the photogrammetric measurements, various methods will be used. For the photogrammetrical method, well visible control points defined in 3D coordinates of the state coordinate system are needed. The number of

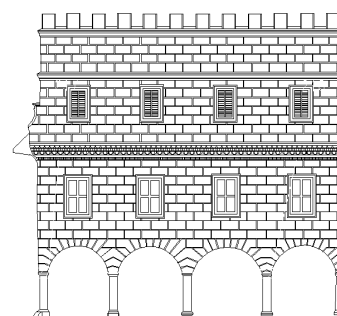


control points differs with the method; usually it is necessary to determine 6-10 control points for each object. For the connection to the neighbouring object some further connecting points will be used. Due to number and complexity of the objects approximately 1000 control and connecting points must be measured and connected with the state coordinate system. A special geodetic micro-network was stabilised and measured by the geodetic company in Jihlava. For determining of control points two methods are used - the classical surveying methods by Sokkia total station and the method of analytical aerotriangulation (AAT). A part of Telc square with configuration of historical objects in one line was used as an example.

### 2.2 Processing of Photogrammetric Images

Several photogrammetric technologies will be used according to the object type. The horizontal facades and paintings can  
Figure 5. Vector processing

be measured by means of one image photogrammetry. All the objects will be photographed classically from the defined





ground basis in one line (as by aero-methods). The given row of images can be adjusted

(using a film 6x6) and a digital camera Olympus Camedia 2500L and E10 (with 2.5 or 3.3Mpixel sensor). The



Figure 6. Photomosaic

(bundle adjustment). For this precise work the images taken by the camera UMK 10 (Zeiss Jena, planfilm 13x18 cm)

processing of photogrammetric images will be done by different technologies. The images from RolleiMetric can be processed on computer with special resection software CDW. The images from other cameras can be processed by different

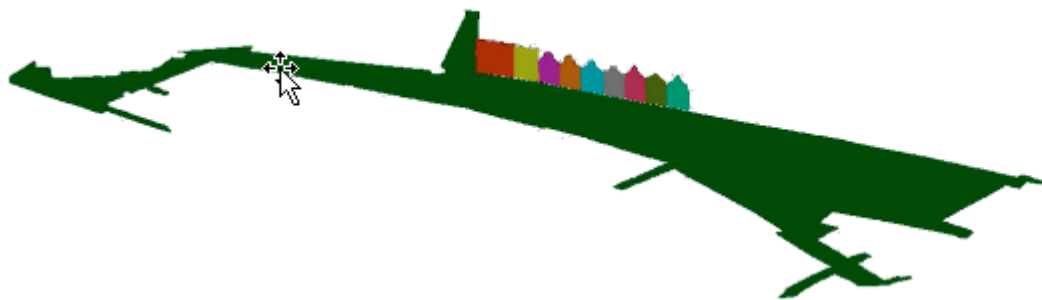


Figure 7. Model

were used. The other used cameras were RolleiMetric 6006

methods. The first step is digitising of images. In the case of RolleiMetric reseau camera, it is possible to use a common scanner with 600-800 DPI for enlarged positives. It is better



Figure 8. Rendering

to use good film scanners– we use a new Nikon Coolscan 8000 with resolution 4000dpi for a maximum format 6x9cm.



Figure 9. Animation

For the negatives from photogrammetric large format (13x18cm) cameras the use of an expensive photogrammetric

scanner it is necessary. The processing of digital images is made on softcopy photogrammetric systems ImageStation SSK and the Czech system PhoTopol. Partly, small stations Leica DVP and VSD can be used. A good condition of the model must be supported by multiphoto orientation. The images taken by terrestrial cameras were pre-processed in the case of Telc by using analytical aerotriangulation as a bundle adjustment and for control points compilation. Special software systems as an AeroSys, ORIENT, Photomodeller or ISAT (ImageStation) for AAT can be used. Until now, only a part of historical square of Telc has been photographed, measured and processed. One



Figure 10. Romanesque church St.Jakub, interior

part of historical square was processed using of all above-mentioned method. The AAT methods seems to be good for this purpose, nevertheless there is a slight difference in results of AAT processing done by different software



Figure 11. St.Jakub, vector 3D model

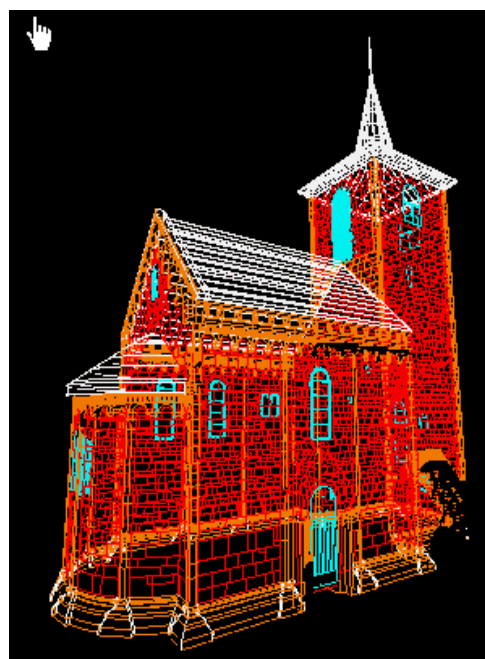
systems. MicroStation and AutoCAD systems can contribute to better precision of image processing. Vector output, rendering and animation software as Photomodeller or Multigen with export to VRML (Virtual Reality Modelling Language) files were used for final presentation.

### 2.3 Animation of Single Object

The romanesque church of St.Jakub in Vrutek village was the object used for precise documentation and animation. In this project classical geodetic measurements of control points were done. The digital camera Olympus and Rollei reseau camera collected the image data. Processing on 3D model was made on Imagestation SSK and Czech system PhoTopol. Firstly, a base vector model was created, which was then transferred into a raster rendered model and finally to an anaglyph 3D rotating model in the MicroStation (Bentley).

### 2.4 Database of Historical Monuments

All the used methods are in close connections to the basic project of Laboratory of Photogrammetry. It is the long term project called „Database of Historical Monuments in Czech Republic“. The project objective is to create the most extensive database and measure photo-documentation of historical monuments in the whole territory of the Czech Republic. The database will be also available on the Internet. The concept of project was made in year 2000 [1]. The project carried out at the CTU in Prague at the Department of Mapping and Cartography (Laboratory of Photogrammetry) with the co-operation of other experts. One year after the project start, there is a lot of experience with digital monument documentation and presentation. At that time we prefer small objects and simple documentation and processing. In the coming years we hope to get about 90 small students projects per annum. Some interesting projects will be further processed into a simple 3D model. Currently a web interface for data input into the Internet has been



finished. Next, a

Figure 12. St.Jakub, vector 3D model

question how to browse and search the data will be answered. We prepare forms for filling the project data by students through the web, for saving the data and for modifying the data, which have been already saved. Furthermore, it will be possible to generate information about projects according to the selected criteria. For example, the position of



building in Czech Republic, the type of building, the selection according to the name and so on. The data will be saved in XML format, which can ensure data homogeneity. Each project will have an identical structure, unlike at this time, when each project is created in statically HTML pages and new projects have often different logic of data organisation and graphic layout. In this time it is only a first – version of XML file structure.

### 3 CONCLUSION

In the near future the “Database of Historical Monuments”

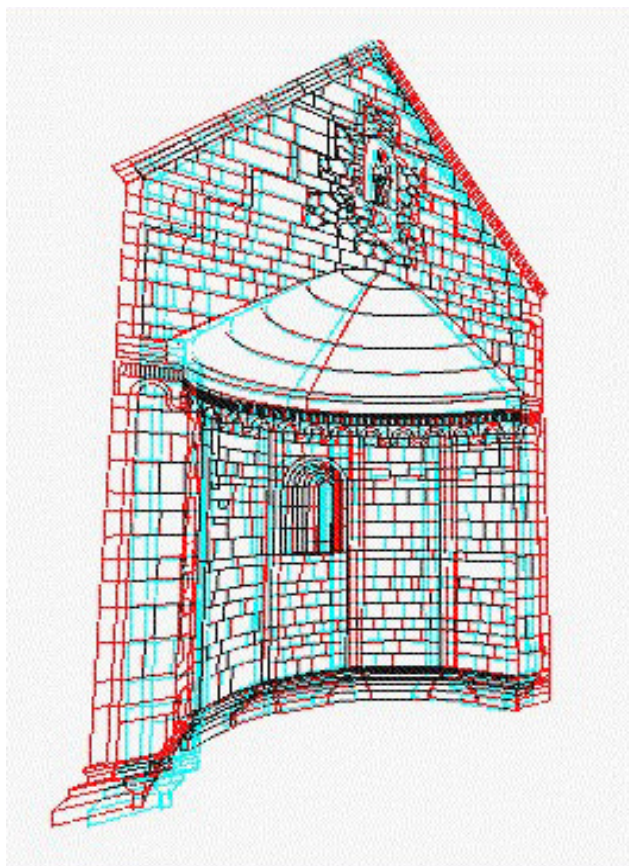


Figure 13. St.Jakub, anaglyph rotating 3D model

on Internet will be available. The co-operation between Laboratory of Photogrammetry and other institutions (Faculty of Architecture at CTU, State Institute of Care of Historic Monuments, Institute of Chemical Technology in Prague, Faculty of Nuclear Physics and Physical Engineering) will be continued. Moreover, we plan expand with this project also to other universities in the Czech Republic (TU Brno and West Bohemia University Plzen) and to exploit the students' potential.

### 4 REFERENCES

Cepek,A., Pavelka,K., 2001, The establishing of historical monuments database in the Czech republic, ISPRS Commission V, WG 6, International Workshop, Ayutthaya, Thailand, pp. 153-158.

Kubelík,M., Musílek,L.,Pavelka,K.,Pavlík,M., 1999, The Vaulting of Vladislav Hall in the Prague Castle : Structural



Figure 14. St.Jakub, raster rotating 3D model

and Constructional Problems, 6.th International Conference on „Non-Destructive Testing and Microanalysis for the Diagnostic and Conservation of the Cultural and Environmental Heritage , Roma, Part III, pp.348-359

Pavelka, K., 1999, Using of Close Range Photogrammetry for Historical Buildings Documentation, Proceedings of Workshop CVUT Prague, pp.589-592

Pavelka, K., 2000, Using of Digital Photogrammetry, GIS and Internet Technology for Historical Buildings Documentation and Presentation, Istanbul, TICT 2000, Bosphorus University,

Musílek,L., 1998, The Laboratory of Quantitative Methods in Research of Ancient Monuments, Workshop CTU Prague, Prague, Workshop Proceedings, pp.115-119

Laboratory of Photogrammetry, 2001, Laboratory web site

[http://gama.fsv.cvut.cz/~hodac/vyuka/laborator\\_ftgm/](http://gama.fsv.cvut.cz/~hodac/vyuka/laborator_ftgm/)

Waldhäusl,P., Ogleby,C. 1998, 3-by-3- Rules for Simple Photogrammetric Documentation of Architecture, CIPA Web Pages, <http://www.isprs.org>

Town Telc, 2002, Town overview, web site:  
<http://www.telc.cz>